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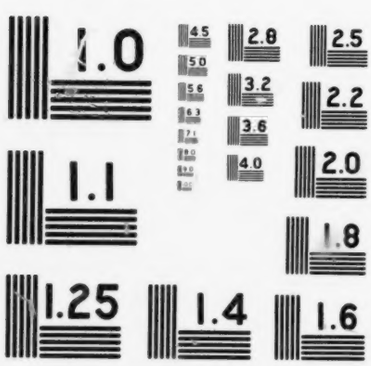

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SCHOOL PLANTS AND SCHOOL DISTRICT ORGANIZATION.

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DESCRIPTORS- ARCHITECTS, ADMINISTRATIVE PERSONNEL, BUILDING IMPROVEMENT, BUILDING DESIGN, BUILDING OPERATION, *BUILDINGS, *EDUCATIONAL SPECIFICATIONS, EDUCATIONAL COMPLEXES, NEEDS, OBJECTIVES, SCHOOL BUILDINGS, SCHOOL MAINTENANCE, *SCHOOL PLANNING, SCHOOL SAFETY, SURVEYS, SCHOOL CONSTRUCTION,

A DESIRABLE SCHOOL PLANT IS ONE WHICH PROVIDES A PHYSICAL ENVIRONMENT WHERE THE LEARNING AND TEACHING PROCESSES CAN PROCEED AT THE MAXIMUM RATE. THE OBJECTIVES OF MAJOR CONCERN IN SCHOOL PLANT PLANNING ARE--(1) SPATIAL ADEQUACY, (2) QUALITY, (3) SAFETY, (4) AESTHETICS, (5) ADAPTABILITY, AND (6) EFFICIENCY AND ECONOMY. CERTAIN SEQUENTIAL STEPS NEED TO BE FOLLOWED IN ORDER TO OBTAIN AN ADEQUATE AND DESIRABLE PLANT. FIRST, THE EDUCATIONAL OBJECTIVES OF THE SCHOOL COMMUNITY SHOULD BE FORMULATED. SECOND, AN EXTENSIVE SCHOOL PLANT SURVEY NEEDS TO BE CONDUCTED. THIRDLY, THE EDUCATIONAL SPECIFICATIONS FOR EACH BUILDING MUST BE PREPARED. THE FOURTH STEP IS ARCHITECTURAL INVOLVEMENT AND PLANNING. THE PLANT PROGRAM SHOULD BE IMPLEMENTED BY FOLLOWING THESE STEPS--(1) OFFICIAL APPROVAL OF THE PROPOSED PROGRAM, (2) INFORMING THE PUBLIC OF THE DISTRICT'S PLANT NEEDS AND THE PROGRAM PROPOSED FOR MEETING THOSE NEEDS, (3) THE USE OF AN ARCHITECT TO TRANSLATE THE PLANT NEEDS INTO PLANS AND SPECIFICATIONS, (4) BUILDING CONSTRUCTION, (5) SITE DEVELOPMENT, AND (6) FURNITURE AND EQUIPMENT. AFTER CONSTRUCTING A SCHOOL PLANT, IT IS ESSENTIAL TO ESTABLISH A GOOD MAINTENANCE AND OPERATION PROGRAM. A BIBLIOGRAPHICAL REFERENCE SECTION IS INCLUDED. (ES)

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SCHOOL PLANTS AND SCHOOL DISTRICT ORGANIZATION

by

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March 29, 1968

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FOREWORD

The impact of scientific, technological, social and economic change on the American way of life necessitate a re-examination of the educational system. These changes modify established needs and create new needs to be met by the public school system. Instructional programs and supporting services must be developed to meet these needs.

The primary purposes of school district organization are to make possible: (1) the desired quality or excellence of the programs and services; (2) the efficiency of the organization for providing the programs and services; and, (3) the economy of operation, or the returns received for the tax dollar invested in education.

School building construction, school building remodeling, school building maintenance and operation constitutes one major area in school business management. Furthermore, they represent a significant portion of the taxpayers educational dollar. Noteworthy savings and services have been observed in those districts which have been able to employ highly trained and competent personnel in these fields. Also, it has been observed that small districts delegated such responsibilities to administrators who are generalists in the field, lacking the detail and apecialized knowledge required for efficiency and economy of operation. Dr. George Englehardt, a specialist in his own right in the field of school buildings, was invited to assess the relationship, if any, between the quality, adequacy, and economy in school building planning, construction, remodeling and operation as related to school district organization. The following paper represents his report to the profession on this topic.

The value of this paper rests upon its utilization by those with advisory and/or decision making responsibilities about the educational structure in each state. It represents a beginning point for further study and evaluation, and for establishing criteria upon which guidelines can be developed for effective and constructive school district organization.

Respectfully submitted,

Ralph D. Purdy, Director
Great Plains School District
Organization Project

March 29, 1968

SCHOOL PLANTS AND DISTRICT ORGANIZATION

I. INTRODUCTION

In developing this paper an effort has been made to present, in general outline form, the major processes and activities which the officials of a school district will be concerned in establishing a program of planning and constructing new facilities, improving existing ones, maintaining and operating present and possible additional facilities in the most effective, efficient and economical manner. It was not deemed necessary to completely detail every step in each process and describe in full every activity in order to establish the procedures that enter into the formulation of a plant expansion and improvement program and in its maintenance and operation.

Recognition is given to the concept that public education from kindergarten through the university is undergoing rapid changes and that these will accelerate in the years ahead. This concept as it relates to the school plant suggests that those involved in the planning process will need to produce school plants that can be readily and economically adjusted to accommodate, insofar as possible, the changing educational programs and the manner in which they may be operated.

The complexities that must be built into school plants for present and possible future use in order to obtain the desired school living and learning environment challenges the ingenuity, imagination and creativeness of both the educational and architectural planners. It also moves the personnel responsible for the care and operation of the plant from the janitorial concept, which connotes the responsibility for building a fire in the morning and sweeping out in the afternoon, to the multiplicity of activities which can only be adequately performed by a team of trained, skilled and semiskilled workers responsible for the custodial care and operation of these plant facilities.

Production of a school plant that will interfere the least with the operation of the school programs now and in future years, and will also provide a physical environment in which the learning and teaching processes can go on at the maximum rate, are objectives of the school plant which may be achieved only by utilizing processes and activities, such as those presented in this paper, for acquiring the necessary information and guidance.

Responsibility for obtaining school plant facilities, in most states, rests primarily with the local districts. The extreme differences that exists among these various units in the demands made upon them for education, available financial and human resources, public school population and geographical area significantly affects the kind and quality of educational plants which they can obtain. These common and related features of plant facilities and school district structure influences the scope and quality of education which the public schools provide.

The satisfactory school district, in terms of plant facilities, is one that can perform its several functions in acquiring, operating and maintaining plant facilities that provide the physical environment in which all pupils from kindergarten, or pre-kindergarten, through the secondary school can experience the learning activities which meets the individual needs of every pupil and the society of which he is a part. The kind and quality of plant facilities which

will provide the desirable physical environment and the processes involved in obtaining them, are a significant part of this paper.

II. OBJECTIVES OF THE SCHOOL PLANT

The activities involved in planning school plants have for their purpose the creation of an end product - the completed school plant - that will provide the physical environment in which learning and teaching can be effectively done. One writer has said "The school is for learning - not just for teaching. And the physical environment is a powerful force in this learning process."[2] The child at school lives, works and plays in the environment provided by the plant facilities and his learning process and mental development may be promoted or impeded by it. To obtain the physical environment that will provide conditions conducive to good teaching and learning is the responsibility of those engaged in the planning of school plants.

School plant planners in their consideration of all the desirable features which the completed plant must possess will need to be concerned with goals or objectives which must be realized in the development of adequate and desirable plant facilities.

In the listing and explanation of plant objectives which follow, consideration has not been given to their priority of importance and the order in which they appear has no special significance. This listing of these objectives is not meant to be all inclusive but represent, in the opinion of the writer, those which are of major concern in school plant planning.

A. Spatial Adequacy and Desirability

One of the important objectives of a school plant program is to provide adequate and desirable space organized and treated in a manner that allows the educational program to be carried on in an effective manner. To accomplish this, the plant must provide for the following:

1. Accommodation of all pupils presently enrolled in each division of the school system, and the estimated numbers that will be enrolled during the years immediately ahead.

2. Operation of a school program designed to meet the needs of all pupils in each of the school's divisions which involves numerous educational activities and groupings essential in the teaching and learning processes. This requires areas for individual work and study which include such activities as reading, researching, recording, listening, viewing, and constructing. There is also involved adequacy of space for such activities as large and small groupings of pupils for class discussions, seminars, reporting, physical activities of various types including physical education, organized games and athletic contests.

3. Services which the school provides its pupils and staff including library or instruction materials center for use in storing, distributing, accounting and utilizing the various instructional media. Offices and areas for work of staff in providing administrative, supervisory, clerical, health and custodial services. Offices for guidance and counseling and special facilities for cafeteria and transportation services. Adequate conference, work and relaxation rooms for use of the professional staff.

4. Site or grounds area for outdoor instructional and learning activities involving individual and group play, directed physical education programs, organized game and athletic events. Also space for building structures and their possible expansion, driveways, bus loading and unloading, walks, lawns, shrubs, trees and vehicular parking areas. Service drives, loading and unloading docks. School gardens, nature trails, biological science laboratory areas are other activities when included in the school program, will require space on the school grounds.

5. Schools require large quantities of materials and supplies for operating the instructional service and custodial programs. In districts with several separate plants a central storage building may be provided and all deliveries of incoming goods are made to this center. After proper checking and recording of items received deliveries to the various school begin in accordance with the established program of receiving, storing and distributing the various items. Location, size and layout of a central storage building or warehouse will depend upon availability of land, size of school system and school policies regarding the handling of all these items.

   Provisions for storage in the individual buildings will depend first upon whether or not central storage is provided. If all incoming materials and supplies are to be delivered directly to each plant by commercial carriers the following facilities should be provided:

   a. Loading and unloading dock served by all-weather driveway.

   b. Central receiving and storage room.

   c. Ample storage areas in certain departments of a high school such as industrial arts, art and crafts, science, vocational departments, business education, library, physical education and athletics.

   d. Strategically located custodial storage room in close proximity to such areas in the building as: toilet rooms, cafeteria kitchens, shower and dressing areas.

   e. Separate storage room for power lawn mowers, tractors and other equipment for special use by custodial staff.

   All storage areas should have shelving and counter space in accordance with need. Custodial closets should have service sink and water available.

B. Quality of Plant

The quality of a school plant will definitely affect its economy of operation and maintenance, period of usefulness and the type of physical environment it provides. The following items indicate quality features:

1. The type of materials used in the building structure or structures, quality of workmanship obtained in the construction process, and the appropriateness of materials selected and used for interior finishes on walls, floors and ceilings in the various areas of the structure.

   A quality building has its foundation, walls and roof areas that are exposed to the elements constructed of materials that are structurally

adequate, resistant to weathering but incorporated into the structure in a manner which creates an interesting and attractive appearance. Interior finishes are the type and kind that produces a pleasing and inviting physical environment, functional in character and easily and economically maintained.

2. Service systems - heating, ventilating, plumbing and lighting - that are adequate in capacity, function effectively, and can be economically operated and maintained.

A quality school plant provides at all times spatial, thermal, sonic and visual environments which are adequate, comfortable and inviting to pupils and staff in which teaching and learning activities can function effectively.

3. Furniture and equipment used in the instructional and learning processes are constructed of materials that will withstand normal school usage, function effectively and retain original usefulness over a period of years.

4. School plant facilities located so that those served can reach it by all-weather roads, streets or walks using conventional methods of travel. Environmental surroundings are wholesome and of a character that contribute to the learning processes.

5. Grounds are of sufficient size to provide adequate total space that can be developed to accommodate the outdoor programs of play and recreational activities which the school and community may sponsor. The development should include lawns, shrubs, trees and other plantings arranged in a manner that enhances the attractiveness of the entire plant.

C. Health and Safety

Every school plant program must have as one of its objectives the providing of facilities that protect the health and safety of pupils and staff. Its importance is recognized by school plant planners as indicated in the following quotations: "The safety of school children is a serious public responsibility".[13] "There is an important, in fact compelling, sense in which the safety aspects of the school plant transcend all other plant considerations. Parents would prefer an unschooled child to a maimed one or one who had died because of an unsafe school building".[2]

The following items contribute to protection of the health and safety of those using the school plant facilities:

1. Building service systems selected and installed that have adequate capacity to provide, and controls necessary for maintaining, a satisfactory physical environment, and can be operated and maintained in an efficient and economical manner.

2. Sanitary facilities for each of the sexes installed in sufficient numbers and in locations that makes their accessibility convenient for all pupils that the plant will be designed to serve. Toilet facilities for kindergarten pupils, and in some schools for all pupils in the primary school grades, should be a part of the total room space, but located and constructed so that proper visual shielding assures some degree of privacy.

Fixtures in all toilet room areas should be constructed of impervious materials which can be easily cleaned and sanitized. The selection of sizes and mounting heights of all fixtures should be based upon the age and grade levels of pupils to be served. Floors, walls, dividers and shields constructed of materials that have smooth surfaces which can be readily cleaned and sanitized, and are resistant to moisture. Mechanical ventilation, independent of the main system serving other areas of the building, should be provided in all toilet room areas.

3. Clinical health service space needs to have toilet facilities available, lavatory with hot and cold water, work counter, storage for first aid supplies and sanitary cots with visual screens for proper shielding. Additional equipment will need to be made available for use of school nurse, doctor and dentist where these services are provided by the school.

4. Space for the storage of all foods used in the school cafeteria must be in areas that have the facilities for providing adequate ventilation and temperature controls. Cafeteria equipment for preparing and serving food must be of the kind and constructed in the manner that meets sanitary requirements of the National Sanitation Foundation.

Safety features which the school plant will need to provide include the following:

1. All load-bearing elements of building structures designed and constructed to support and withstand maximum forces of nature and shifting loadings that will result from all anticipated activities by the occupants.

2. Circulation and egress facilities designed and built into the structure enabling occupants to evacuate the building in minimum time and with a reasonable degree of safety.

3. Fire safety features incorporated into the building structure which includes:

   a. Materials used in construction of any and all loadbearing elements to be fire-resistive.

   b. Heating equipment located in a room of fire-resistive materials and separated from other areas of building by automatic closing fire-retardent doors.

   c. A fire alarm system which will have a signal different from any others used in the building. System to be installed should conform with standards set by state or local fire codes or by the National Fire Protection Association Code.

   d. Electric wiring and equipment must be in accordance with state, local and/or National Electrical Code.

4. Other built-in safety features which include the following: (a) ramps for stairs when change in level is two feet or less, (b) nonslip stair treads, (c) safety glass in exit doors, (d) installation of masonry units with rounded edge forming interior corners in circulation areas, and (e) numerous others which may be obtained from school planning guides such as the one published by the National Council on Schoolhouse Construction.

5. Some safety features that must be considered in site development are as follows:

   a. Restraining fence between play area and streets which have a heavy flow

of traffic.

b. Playground surfacing of materials that contain a minimum amount of abrasive features.

c. Site area free of ditches, stumps, partially hidden rocks and other trip hazards.

d. Playground equipment free of sharp corners and edges and all other features offering hazards to users.

D. Aesthetics

School plants with their attractively designed and constructed buildings, well kept lawns, shrubs and trees appropriately placed and maintained are often interesting places which local citizens are proud to show their visitors.

Aesthetically pleasing and attractive school plants do not occur by accident but rather only after much conscious effort by the design profession. Beauty in a school building is the application of imagination and creativity by the architect. While school buildings must be functional, they need also to be humanized by means of form and color. One author has said "The ability to see is as important as the ability to read and write, and it, too, must be taught. The training of the eye to perceive and appreciate all the aspects of the world around us, from the accidental designs of nature to the man-made patterns of architecture, is a fundamental factor of learning".[5]

The school plant that provides beautiful surroundings for its pupils stimulates their appreciation of the creative arts and encourages pride and respect for their school home.

For many pupils the school which they attend offers the only source where they can live with and be surrounded by some degree of beauty expressed in form and color. The drabness of their home environment makes the visual experience in the school their principal means of contact with beauty in its physical forms enhanced by color, harmony and balance.

To create an aesthetically pleasing plant the architect will need to give special attention to such design features as:

1. Orientation and location of building on site to utilize topographical features which may add significantly to aesthetic quality of the plant.

2. Choice of materials of construction and their use and placement in the building which offers the architect an opportunity to create a structure with textural relationships of materials that could incite interest in and appreciation for its beauty.

3. Spatial areas located and designed so they provide both closed and open environments through which traffic flows may serve to excite the imaginative child

4. Use of color in floors, walls and ceiling provides a means of creating interest and appreciation for the building they occupy.

5. The handling of lighting services both natural and electric may serve to enhance aesthetic qualities of the physical environment.

E. Adaptability

School grounds are acquired, buildings planned and constructed for both immediate and long-term use. Many school plants presently in use have continuously served the districts in which they are located for more than a half century. Most of them have gone through one or more programs of reconditioning and modernization. School plants may, however, become obsolete and abandoned for further use as instructional centers due to any one, or a number of reasons, some of which are as follows:

1. Location,

   A school plant may become obsolete as a result of being located in a community which has been, and is continuing, to lose pupil population as a result of changing economic and industrial conditions. This has become quite common in the strictly rural areas of much of the midwest. Changes that have been made and are continuing to occur in the farming enterprise results in larger and fewer farms which are operated, with the aid of modern machinery, by fewer workers. Movement of rural people from farms to cities have considerably depleted school population in these areas. Thousands of small rural school plants have been abandoned during the past decade because of obsolescence caused by loss of school population and changing educational demands.

   The large cities have areas that were once residential but these homes have been replaced by business and industrial expansion with the result that school population has become so depleted that the plant must be abandoned.

2. A small site with inadequate space for building expansion to accommodate increasing school enrollments may hasten obsolescence if expansion is impossible due to prohibitive cost for additional land. Some plants of this type can be continued in use by remodeling and redesigning existing building so that vertical expansion can be made and play areas provided under, inside and on roof area of the structure.

3. Deterioration has resulted in making structural members inadequate for support of the shifting pupil load which the building must support.

4. Building design is of the type that adjustments cannot be made due to structural system use, and the existing spaces will no longer accommodate pupils, programs, services and staff.

One of the desirable objectives of a school plant is that the planning and construction is done in a manner that makes adaptations possible for meeting the housing needs for accommodating the changes in pupil population, educational programs, pupil activities and services which the school provides its pupils and staff. Such a school plant will have the following features:

1. Grounds sufficient in size for the ultimate school planned for this specific attendance center.

2. Building structure with load-bearing elements distributed so that internal spaces can be expanded or reduced in sizes by walls that can be readily and easily moved, and exterior walls and interior arrangement makes building expansion practical and economical.

3. Service systems located so that distribution lines are kept out of nonload-bearing walls and can be readily and economically changed to supply needed services in internal spaces as they are adjusted to meet program needs.

F. Efficiency and Economy

Since public schools have certain limitations on their ability to raise funds for obtaining plant facilities, it is extremely important, if not imperative, that proven measures of economy and efficiency be employed in securing and developing sites and in the planning, constructing and equipping of building units.

A popular conception of an economical school plant is one that can be obtained for the least expenditure of funds. This conception is not necessarily true as indicated in the various definitions of economy which have been stated in publications concerned with planning and constructing school buildings. A definition by the New York Commission on School Buildings states that: "Economy as applied to school house construction implies a wise and carefully managed expenditure of school funds in providing facilities which are adequate in terms of needs of the educational program at the most reasonable cost."[20]

"True economy is a complex relationship between original cost, educational utility and efficiency, and maintenance and operation expense."[2]

"Economy in education begins long before the actual building does, before the foundations are dug or the footings are even blueprinted; it begins with a motive."[16]

Some measures which can be utilized in obtaining plant facilities in an efficient and economical manner are as follows:

1. Develop a long-range plant program which is based upon the estimated number of pupils that will be in each division of the school system and kind and scope of educational programs and services to be provided in each division and the extent of housing each will require. Such a plan helps avoid the possibility of overexpanding or overspending at one center, or for one division, which may result in delaying much needed facilities in another division or at a specific school center.

   The long-range plan, coordinated with other agencies in total community planning should make possible:

   a. Selection of sites for future plant locations which may make possible some extension of the period of usefulness of these plants. Planning and constructing a school plant at a location where it will be used for only a few years may prove to be an unwise expenditure of funds. An example of such action is found in a few school districts in Missouri that were formed by the merging of a small village district with surrounding rural ones. The resulting enlarged districts had a very limited school population at the time of their formation, but bonds were voted and one or more new school plants planned and constructed. Declining rural population depleted school enrollments to the point that certain buildings had to be

abandoned before half of the bonded debt against them had been retired. The plants abandoned were only partially adequate in that they failed to provide space for operating some of the areas of a modern educational program, yet the original cost per pupil was well above average. Cost per pupil based upon use of the plant for less than ten years, when forty to fifty years is normal expectancy, was exceedingly high amounting to four or five times the average per pupil cost for buildings which serve their usual period of usefulness. Planning and constructing these small plants has proven to be an imprudent use of public funds.

b. The long-range plan should also enable school authorities to acquire sites for new school centers well ahead of land development in those areas designated residential by the community plan.

2. Educational planning can contribute to effective and economical school plants by establishing the overall educational program and services which are to be housed. Such a program would include most of the following:

   a. Purposes of education in the community such as cultural or college oriented, or vocationally slanted.

   b. Scope of program which may be kindergarten through grade twelve, or junior college, and specialized programs to include vocational and technical education.

   c. Organizational plan such as elementary and secondary with one or more divisions of each.

   d. Extent of curricular offerings and possible additions or deletions.

   e. Teaching methods and class sizes.

   f. Extent of pupil and staff services, and provisions for special types of education.

   g. Optimum size of school centers in each division of the system.

   h. Detailed educational specifications for the individual plant. Carefully planned and detailed educational specifications for a particular plant makes possible one that contains all spaces and facilities essential for accommodation of pupils, programs and services. Plants with excessive or unnecessary spaces and facilities or with less of these than required are neither efficient or economical.

3. Design and construction of building can affect efficiency and economy by:

   a. Location and orientation of building on site to avoid excessive driveways, excavations and grading.

   b. Completeness of design documents enabling contractors bidding on the project to accurately determine kind, quality and quantity of materials and the manner in which these are to be incorporated into the structure. When drawings and specifications are incomplete contractors usually bid high for protection. Change orders to correct deficiencies or inaccuracies in design documents are added costs.

c. Use of materials and equipment that are readily available and of the kind and quality appropriate for the area in which they are used. Low quality materials and equipment usually mean excessive long-term costs for maintenance and operation.

d. Design is of the type that takes advantage of efficient and economical enclosure of space and the layout and arrangement of it.

e. Bidding practices contribute to economies by:

(1) Advertising for bids in publications as required by law and in trade journals which are available to most contractors.

(2) Establish bid date at time of year when contractors usually have a minimum amount of work committed.

(3) Invite and encourage a number of contractors to bid that have a record of good work in order to obtain maximum competition and quality workmanship.

4. Size of school plants affects efficiency and economy.

Costs involved in planning, constructing and operating a single school plant for housing a high school of 500 or more pupils will be considerably less than for two separate plants each accommodating half that number. Areas in which these economies and efficiencies can be made are as follows:

a. Initial cost savings in the larger unit

(1) Acquisition and development of sites.

The original cost of acquiring and developing a site of 40 acres for the large school will be considerably less than for two of 25 to 30 acres each. More complete utilization of the land area is possible since a greater number of classes in physical education, and other outdoor activities, makes continuous use of the various areas.

(2) Savings can be made in the building planning and construction processes by reduction in the costs of architectural services, contractor's overhead, managing and directing construction, quantity of materials used, and supervision by the owner or owners.

(3) Purchase and installation of building service equipment including heating, cooling, ventilating, plumbing and sanitation systems. Cafeteria kitchen and other building equipment would not require dual installations. More efficient use of much of the instructional equipment would be obtained by greater utilization of it.

(4) Eliminating duplication of large building areas such as gymnasiums, auditoriums, cafeterias, shops and administrative offices.

b. Maintenance and operation savings in larger units.

(1) Reductions in fuel and energy consumed for operating one rather than two building service systems.

(2) Some reduction in custodial work is possible due to less total building and grounds area to keep. There would also be fewer toilet, shower and dressing rooms to be cleaned and sanitized.

(3) Maintenance would be reduced due to less foundation, exterior wall and roof areas to maintain. Also less building and instructional equipment to maintain.

Operation and upkeep are recurring costs which continue throughout the useful life of a building. Total expenditures for these services during the long period could prove to be considerably more productive than any others which offer some savings.

To illustrate the effect of size on high school building construction costs in Missouri twenty-one projects, which have been completed during recent years, were selected and divided into the following three groups:

a. Five of the buildings were selected for the first group which house high schools with an average enrollment of 159 pupils. The space provided in these buildings amounts to an average of 200 square feet of floor area per pupil. The range in enrollment is from 99 to 228 pupils, and from 287 square feet per pupil in the one with 99 pupils enrolled to 180 square feet of floor space per pupil in the one with 228 enrolled.

b. The second group of projects selected consisted of nine buildings for housing high schools with enrollments between 250 and 500 pupils. The average enrollment in the nine schools amounts to 365 pupils. These buildings provided an average of 165 square feet of floor space per pupil. The range in enrollment is from 285 to 441 pupils. Square footage per pupil ranged from 195 in the school with 285 enrolled to 124 in the one with 441 pupils.

c. Seven projects were selected for the third group. The average enrollment is 609 pupils and the average square footage is 110 per pupil. Range in enrollment is from 590 to 771 pupils. The square footage of floor space ranges from 122 square feet per pupil in the school with 590 pupils enrolled to 110 square feet per pupil in the one with 771 enrolled.

If contracts for the construction of these 21 buildings were all awarded at the same time at a cost of $14 per square foot of floor area, the first group would cost an average of $2,800 per pupil, the second group and average of $2,310 per pupil, and the third group an average of $1,540 per pupil. These figures are presented only for the purpose of illustrating economies which could be made in providing building facilities for school districts of sufficient size to have an average high school enrollment of 600 pupils compared with those having enrollments of less than 250 pupils.

The savings that could be realized on building construction only are quite significant but do not include those that might be realized from plant planning, site acquisition and development, building and instructional equipment, and maintaining and operating the plant facilites.

Addition of these possible economies to those which can be achieved in building construction provides further evidence that size of school plants definitely affects their costs, and that school districts with high school enrollments of less than 600 must spend considerably more per pupil for plant facilities than those with larger enrollments.

5. Develop and implement a financing plan that will provide necessary funds at minimum cost.

Methods of financing plant programs are either on a credit or pay-as-go basis. The pay-as-you-go plan necessitates obtaining funds from a special tax levy that is u s ed to build a reserve for financing capital outlay projects. This method eliminated interest payment and obviously reduces total costs. The credit plan requires either short- or long-term bonds for financing purposes. Since the issuing and sale of bonds is the most common method used for this purpose, it should be noted that considerable savings can be affected by planning bond sales so that the least amount of interest will be paid for securing the funds. Observing the following practices should result in achieving this goal:

a. Sell when bond market is most favorable.

b. Issue bonds in denominations most attractive to buyers.

c. Obtain competitive bidding.

d. Prepare prospectus for distribution to prospective bidders.

e. Establish credit rating of the school district with one of the nationally known agencies that maintain ratings of political subdivisions, including school districts.

III. STEPS IN PLANNING SCHOOL PLANTS

School plant planners must, in cooperation with school officials, professional staff and lay leaders, determine and agree upon the educational objectives of the school community served, scope of the educational program to be offered, curriculum content and all necessary and desirable services that are to be provided for pupils and staff agreed upon. During the planning process certain sequential steps will need to be followed in order to obtain an adequate and desirable educational plant.

Step 1. Educational Objectives of the School Community.

These objectives will need to be developed under the guidance and leadership of the chief executive of the school organization, the superintendent of schools. Their development should involve the combined efforts of the members of the governing board, administrative staff, professional staff and leaders of the school community. Representatives from each of these groups should be selected by the board of education to form a committee responsible for the formulation of the philosophy and objectives of the school system and the executive officer of the board serve as its chairman.

State Departments of Education in many states require boards of education to have an officially adopted statement or statements of the

philosophy and educational objectives of the school system. Since these statements need frequent reviewing and occasional revision, it is suggested that an opportune time for such action is at the beginning of a school plant planning program.

Step 2. The School Plant Survey.

The school plant survey is a planned and organized method of collecting and analyzing the pertinent information and factual data about a school system, or other geographical area, for the purpose of determining plant facility needs, the scope of a plant program necessary for satisfying these needs, financial resources of the district for implementing a plant program, a recommended feasible and attainable plant improvement and expansion program based upon the survey findings. Initiating and carrying through a survey of this kind involves the following procedure:

a. Authorization by the board of education upon the recommendation of its executive officer.

b. Agreement upon the type of survey, methods to be used and personnel involved.

c. Assemble, analyze and evaluate information and data about the school district pertinent to the school plant and organizing the findings into a report.

d. Presentation of completed survey report to board of education for their examination and review.

e. Approval, modification or rejection of the survey report by the board of education.

f. When approved, in whole or in part, by the board implementation of the proposed or modified program should be scheduled in accordance with priorities agreed upon.

Since the plant survey involves the gathering, analyzing and evaluating of information and data about the school district which is necessary in formulating a proposed plant program, its development will need to include such areas as the following:

A. Plant needs of the district

In determining the plant needs of a school district it is necessary to examine and evaluate the information that can be obtained about the more significant factors that contribute to these needs. These factors and their contributions are:

1. School enrollments

The total number of pupils that have been, are now and will probably be enrolled in the district's schools during the next several years constitute one of the major factors influencing plant needs. Analyzing trends in past and present enrollments by years, school units, grades, divisions and geographical areas provide one of the means for estimating

future numbers of pupils as well as determining total housing needs and their specific location.

Another means of estimating future enrollments is survival data from birth to school entrance and from grade to grade through the system. Still other data that can be used for projecting school population are: (a) trends in non-public school enrollments, (b) possible expansion of the district by merging with others or extension of boundary lines, (c) in- and out-migration of total and pupil population, (d) trends in enrollment of nonresident pupils.

2. Scope and quality of education programs and services

Extent and quality of the education program that a school district provides for its pupils serves as another means of determining plant facility needs. The influence of the educational program and service provided pupils and staff on plant facility are indicated by:

a. The organizational plan of the school system, which may be in divisions consisting of grades kindergarten through six which is designated as the elementary school, grades seven through nine as the junior high school, and grades ten through twelve as the senior high school. Other organizational plans which groups grades and pupils in different divisions may be advantageous under certain conditions. Plant facilities that provide an adequate and desirable physical environment for learning and teaching are essential regardless of the organizational pattern used.

b. Breadth and scope of curriculum

The extent of course offerings and methods of teaching affect plant facility needs in terms of numbers of teaching stations or classrooms required, and by the type of activities in which pupils engage in carrying on the instructional program. Facility requirements differ, for example, if team teaching, large and small groupings and individualized methods of instruction are emphasized compared with traditional class instruction in self-contained cubicles.

c. Policy of the school regarding size of school units and classes affect plant needs. If the policy of the school system is to have elementary schools of approximately 500 pupils, junior high schools of 800 and senior highs of 1,500 the plant needs will differ from the districts with policies allowing considerably larger units. This will also be true if class sizes are to be limited to specified numbers such as 25 in elementary, 28 in junior high and 30 in the senior high school.

d. Services provided pupils and staff such as transportation, cafeteria, library, administrative, health, guidance and counseling for pupils and work and relaxation rooms for staff influence the plant needs.

B. Plant program for satisfying needs

The development of a plant program that will provide the facilities for taking care of the established needs must first evaluate the existing facilities to determine the extent to which they now, or can be readily and economically made to, fill all or part of these needs.

In evaluating the existing plant facilities it must be remembered that they usually represent a considerable investment by the district and their continuing use, with certain modifications, may be educationally desirable and financially necessary.

The evaluation should be made by personnel that includes professional staff members, educational and plant planners, professional architects and engineers.

A comprehensive and detailed analysis of the existing facilities will need to be made by this group to determine the extent to which they now, or can be made to, conform with the following criteria:

1. Existing plant facilities now, or can readily and economically be made to, adequately protect the health and safety of pupils and staff occupying them.

2. Adaptations can be readily and economically made for accommodating present and possible future enrollments, educational programs, curricular offerings, methods of teaching and all agreed upon services.

3. Unsafe and unfit buildings to be eliminated as soon as possible.

4. Buildings that are in fair condition but do not lend themselves to rehabilitation and do not fit into the approved long-range plant program may be used temporarily until such time as their replacement can be scheduled.

5. Locations are such that they are readily accessible by conventional methods of travel to a sufficient number of pupils to justify their continued use.

6. Neighborhood surroundings are suitable for the educational environment of children of school age.

7. Sites are adequate for present buildings and expansions if found necessary, and for the school's outdoor programs.

8. Complete modernization of the plant making it satisfactory for continued use for twenty to twenty-five year period can be accomplished for approximately fifty percent, or less, of the cost of new facilities.

This evaluation of existing facilities should include a program of improvements and expansions which is essential for their continuing usage. If the plant needs cannot be obtained by implementing this

program, it will be necessary to supplement it with proposals that includes the planning of one or more additional plants.

C. Financing proposed plant program

The proposed plant program developed from the findings of the survey must be studied and possibly adjusted in accordance with the ability and willingness of the school district to obtain the necessary finances for implementing it.

Provisions of the State constitution and legislative enactments limit school districts in the amount of funds that can be obtained for building programs. Most of the school districts in the four states involved in the Great Plains School District Organization Project must obtain funds for capital improvements and expansion from either the sale of general obligation bonds issued by the district, or from current tax levies or a combination of both. Voters in the local districts must approve bond and tax levy proposals for capital outlay purposes.

The urgency of need often determines selection of the methods used in securing funds for building projects. Districts bonded to the constitutional limit will, of necessity, resort to the special tax method for obtaining the necessary funds. District funds secured by either of the methods come from taxes levied on local real estate and personal properties. The willingness of voters to supply the funds is often influenced by the total tax load which properties must bear.

State and Federal funds are available to only a very limited number of specific districts qualifying for them. They represent rather insignificant amoun' compared with total expenditures required.

D. Recommendations

The survey to be complete must offer a program of plant expansion and improvement that is feasible and attainable. It should be the result of a careful analysis of needs in terms of both immediate and long-range planning.

In developing the recommended program several important criteria, in which the following are representative, must be given proper consideration:

1. Total plant needs in terms of a long-range program for the school district should be identified in relation to desirable accommodations for pupils, programs and services.

2. The urgency of needs should be determined and priorities proposed for their solution.

3. The program should allow for possible unforeseen emergencies which may require some changes in it. With the proper planned flexible features, changes can be made without abandonment of the long-range plan.

4. All proposals should be based upon valid information and supporting data.

5. Improvements and expansions that are proposed should be attainable within the financial limitations of the district.

Step 3. Educational Planning

The overall educational planning for a school plant program have been presented in broad outline form in the preceding step dealing with the plant survey. Planning of a single plant, however, should include the specific educational requirements for that project. These specific requirements, or specifications, will prove to be invaluable to the architect as he develops the overall design and detailed layouts in the architectural planning process.

Preparing the educational specifications for a specific building will involve a number of persons from the administrative, professional and maintenance and operation staffs. There may also be included personnel selected from the student body, parent-teacher organization and citizen groups. Representatives from these groups should be formed into committees that will be concerned with different aspects of the educational planning. An executive or steering committee, with the administrative head of the school as its chairman, could be formed and made responsible for combining the work of all committees and preparing the final specifications document that will be submitted to the architect for his guidance. Since most of the personnel selected to work on the preparation of these specifications will be inexperienced in performing such duties, it is important that their efforts be given proper guidance from experienced members of the administrative staff.

Examples of the type information that should be incorporated into the educational specifications follows:

A. General

1. Philosophy and objectives of the school.

2. Type of school - elementary, secondary, special.

3. Number of pupils - by age and grade levels.

4. General design features - single or multiple story - open or compact - flexible or closed.

5. Community use of buildings and grounds.

6. Available finance.

B. Facilities to be provided

1. Space for instructional program.

2. Library or resource center.

3. Administrative offices.

4. Auditorium-gymnasium.

5. Cafeteria.

6. Shops.

7. Storage.

C. Detailed description of spaces and activities in each.

1. Size and location.

2. Treatment - finishes, lighting, heating, ventilating.

3. Furniture and equipment.

4. Numbers of pupils in each.

5. Type of activities in each.

D. Others.

1. Policies of the school system . . . . . .

It should be remembered these specifications are for the guidance of the architect in providing the needed spaces and other design features. They present the problems of design not the solution. The architect is a trained professional in the design field and the restrictions spelled out in the specifications chould include only those features of the plant that are required for meeting the established needs in an efficient, effective and economical manner.

Step 4. Architectural Planning

Architectural services, to be most effective, will need to begin with the initiation of planning activities and extend through construction and occupancy of the plant. He will need to have an understanding and an appreciation for the school's philosophy and objectives. Valuable engineering assistance can be provided in the evaluation of existing facilities which contributes significantly to determination of the district's plant needs. In a consultative capacity the architect can provide technical information on building design, equipment selection, and site development for use by those engaged in educational planning. By working and consulting with the educational planners, he will become well informed on the operational procedures and the various activities involved in the implementation of the educational program and services which the school provides.

IV. STEPS IN IMPLEMENTATION OF PLANT PROGRAM

Planning phases of a school plant program may logically conclude with the presentation of a proposed plan for locating and constructing new facilities and for expanding, rehabilitating and modernizing existing ones along with a realistic financing plan that would produce the necessary funds for its implementation.

The proposed plant program developed in the planning procedures can be realized only after a number of steps in the implementation process have been completed. The more significant steps that must be taken to bring the proposed program into full realization are as follows:

Step 1. Official Approval of Proposed Program

The authority to make official decisions on all policy matters pertaining to school systems is usually exercised by the district board of education. This body is, in most instances, made up of lay members which have been elected by popular vote. Acceptance and approval of the proposed plant program should be made, in whole or with certain changes and modifications, by the board of education before its presentation to the public.

Step 2. Informing the Public of the District's Plant Needs and the Program Proposed for Meeting These Needs

The responsibility of keeping the public informed on matters pertaining to the school is most generally the responsibility of the board of education and its executive agent, the superintendent of schools. The school system's public relation program, which is usually under the general direction of the superintendent, will need to be utilized in making available to the public through the various news media a complete report on the plant program prepared as a part of the plant survey. The factual information and data obtained and used by the planning group in developing the proposed program should also be made available to the public as a means of explaining the extent to which this program will satisfy the plant needs. School systems that have very good continuing programs of public relations may need to give added emphasis to plant facility needs and intensify these programs for short periods of time to obtain approval of bond issues or increased building fund levies.

Step 3. Architectural Services

Establishment of need for additional and improved plant facilities is the responsibility of educational planning. It is also the function of educational planning to spell out these needs in terms of numbers of pupils, programs, activities spaces, facilities and services. Local school authorities, with whatever additional assistance available and desired, have the responsibility of establishing the type and scope of the plant program. These authorities may have adopted certain plant requirements which are to be applicable to all building projects in which the district engages.

It is the function of the architect, working within the limitations established by the school authorities, to translate these plant needs and desires into plans and specifications. The architect can perform his functions most effectively if his services are retained early in the planning phases. He should, for example, meet regularly with the educational planners in order to better understand and communicate with them regarding the educational program and space requirements essential for its implementation.

Services which the architect provides in a plant program begins in its various phases to completion and occupancy. A brief summary of these functions and services follow:

1. Participation as a consultant in the educational planning activities for determining plant needs, evaluation of existing facilities for continued use, and for better understanding of educational programs and space requirements.

2. Advises on site selection in relation to features affecting building design and construction, and on various aspects of its development.

3. Prepares preliminary drawings for critical review by school authorities, their representatives, state agencies concerned with the functioning of school plants, local school staff and other vitally interested persons.

   These preliminary plans include: Perspective sketches, general floor plan, elevations, sections, outline of specifications and cost estimates. Several preliminary studies of this type are often made and presented to the school authorities before a final selection is made.

4. Upon approval of preliminary plans the architect prepares complete drawings and specifications which include:

   a. Plot or site plan with building location and site development.

   b. Detailed floor plans showing space allocations and arrangements.

   c. Perspective drawings showing exteriors and sections of interiors.

   d. Enlarged detail drawings of special areas with equipment locations and arrangements.

   e. Various sections of structure showing heights, walls, foundation and roof details.

   f. Mechanical and electric plans showing details of their installation.

   g. Specifications document describing materials to be used in construction and detailed description of service systems to be installed.

5. Serves as technical adviser to local school authorities on selection of construction materials, mechanical and service systems to be installed, and other plant features.

6. Submits completed drawings and specifications to governing board and State Department of Education for review and approval.

7. Advise with board on establishing a date for bids to be received and for making design documents available to contractors for their use in preparing and submitting bid proposals.

8. Prepares and makes available bid and contract document forms and advises with board on the selection of the builder and award of contract.

9. Does limited amount of supervision of construction for determination of conformity to contract documents, plans and specifications. Also checks progress of work, approves payment requests of contractor, prepares and advises with the board on change orders and requests by contractor for time extensions and maintains check on management by the contractors of all phases of the work.

10. Makes final inspection to determine if all items have been completed in accordance with plans and specifications and recommends acceptance of finished project.

Step 4. Building Construction

Construction of school buildings usually requires considerable sums of public money which must be used in the manner prescribed by state laws. School authorities cannot, for example, award contracts for more money than can be legally used for the building project. Legal enactments also require that construction contracts can be awarded only after advertising for bids has been done for a specified number of days in designated types of publications which are available to the public, and bids have been publicly opened and read aloud.

When the governing board and architect agree upon and definitely establish a date for receiving bids on a school construction project, the following steps must be taken:

1. Advertising for bids must be done in accordance with the applicable laws.

2. Bids received must be opened and read aloud at the time and on the date set out in the advertisement. All bids considered must be prepared and otherwise conform with the INSTRUCTIONS TO BIDDERS appearing in and a part of the specifications.

3. Following the opening of bids the board and architect examines, evaluates and decides upon the lowest and best bid or bids received and if funds are adequate informs the successful bidder or bidders of their intention to enter into contractual agreements for the work.

4. Formal contract documents are executed and construction firm or firms acquire and submit required bonds and insurance coverage guaranteeing performance of work, payment for all labor done and materials used on the job, and insurance coverage protection on all persons employed, and the materials and equipment used in the construction process.

5. Construction schedule is developed and made a part of the contract agreement. This schedule usually sets out time allotments for progress on the project and contains a liquidated damages provision for failure to finish in accordance with time prescribed including approved time extensions allowed by the governing board.

6. Payments are made to contractors in accordance with provisions in contract documents with a specified percentage retained by the school until project is complete and accepted by the board.

7. Contractors are generally held responsible under terms of the contract for one year, following completion and acceptance of project, for failures that are caused by faulty or inferior materials and workmanship.

Step 5. Site Development

The planning for development of the school site should not be completely divorced from the building planning and construction. A well planned and developed site may become a school and community center that serves the school as a learning laboratory and the community as a recreational facility. Its planning and development should be done in accordance with intended uses or its effectiveness will be definitely reduced.

Some of the important factors to be considered in the planning and development of the site are as follows:

1. Planning of site should be a part of the total planning of the plant facilities.

2. The planning should provide for development that could be economically done, and their operation and maintenance will not be excessive in costs.

3. Adequate provisions made for all those activities that use outdoor space.

4. Enhances the attractiveness of the entire plant.

5. Provide for safe and convenient use by pupils, school staff and public.

Step 6. Furniture and Equipment

Furniture and equipment are essential elements of the school plant since operation of the school program would be practically impossible without them. Reference to furniture usually includes such items as desks, chairs, tables and seats. Equipment usually refers to two types of items, those attached and those unattached to the building. Attached items would include such units as built-in lockers, window shades, basketball backstops, folding bleachers and kitchen equipment. While those unattached would be picture projectors, screens mounted on tripods, maps, charts, globes and other instructional equipment which can be readily moved.

Some criteria for selection of furniture and equipment are:

1. Type of school in which it is to be used - primary, elementary, secondary.

2. Type of program operated. New buildings with large open areas in which informality and flexibility are stressed would need equipment and furniture different from the school with fixed self-contained classrooms which has pupil desks in rows and makes little use of the new instructional media.

3. Protects the health and safety of pupils. Children in the same age and grade group differ significantly in physical characteristics

such as height and other body measurements. Furniture of a variety of sizes, or adjustable to meet individual needs, should be provided.

Furniture and equipment that is free of sharp and protruding edges and corners, which could injure pupils, should be selected. Drapes and curtains in buildings should be made of mineral fibers or flame treated. Proper markings around fixed power equipment and adequate safety guards on both fixed and hand power tools in shops should be provided. Playground equipment needs to be free of such hazards as sharp and protruding corners and edges and other features that could injure pupils.

4. Quality of materials and workmanship as well as original cost should be carefully evaluated in selection of these items. They must be sufficiently durable to withstand the use and abuses to which they will be subjected by pupils.

V. MAINTENANCE AND OPERATION OF SCHOOL PLANTS

Planning and constructing modern school plants require expenditure of capital outlay funds in amounts of considerable size. A new school plant is quite often the most expensive and complex public property in the community. Total expenitures for school construction in the United States for the year 1964 amounted to $3,116,000,000 according to a report by Dr. Collins in an article appearing in the November, 1967, issue of School Management Magazine.[30] This article also presents data showing that 76.7 percent of these funds were supplied by local school districts. New plants in many of the school districts in the four states comprising the Great Plains School District Organization Project are financed entirely from local funds.

Electrical and mechanical systems incorporated into most modern school building structures are exceedingly complex. Large amounts of piping, duct work, and electric wiring along with motors, valves, thermostats, switches and other controls that make these systems function are so concealed that most building occupants are unaware of their existance. Proper and continuous functioning of these systems are necessary for the building to have adequate lighting, temperature control, ventilation and sanitation. It is the responsibility of the maintenance and operation staff to keep all service systems, as well as the building structure and equipment performing their functions effectively.

Maintenance and operation are very closely related but are generally considered as two separate functions. "Maintenance involves those activities which are concerned with keeping grounds, buildings and equipment at their original condition of completeness or efficiency, either through repairs or by replacements."[27]

"Operation has to do with those activities concerned with keeping the physical plant open and ready for use. It includes cleaning, disinfecting, heating, moving furniture, caring for grounds, and other housekeeping activities that are repeated at frequent intervals."[27]

Maintenance Program

School districts, with some assistance from funds provided by State and

Federal governments, are making tremendous financial outlays for new and improved plant facilities. The prime purpose of these expenditures is to create physical facilities in which the learning process can function effectively. Maintaining the physical environment provided by plant facilities in a condition that promotes the educational process originally planned, along with protection of the original investment made in them, requires the development and implementation of long-range programs designed to keep these facilities functioning properly and adequately protected against undue depreciation.

In the development of such programs school officials will need to consider the following:

1. Selection of type that can be most effectively and economically used.

   School districts with several different plants may find it both desirable and economical to select the type program that requires the employment of a staff of sufficient size and possessing the variety of skills necessary to do all of the maintenance work required.

   Some districts may find that contracting all maintenance work is the most desirable method of providing adequate care and upkeep of buildings and grounds.

   Other types of programs may be selected in which the local staff does most of the maintenance work but depends upon obtaining the services of non-school craftsmen for assistance with certain projects, or contracts only the work which the regular staff cannot handle.

2. Establishing responsibility.

   The responsibility for performing, or having performed, all the tasks required in a maintenance program must be definitely centered in a designated individual. Staff requirements that will enable the responsible person to perform his functions effectively will depend upon type program, size of school system, availability of craftsmen in the various trades and the possibilities for on-the-job training which can be used in developing the necessary skilled workers.

3. Locating maintenance work.

   A complete inspection of the plant will need to be made by technically trained personnel to locate those elements of the plant needing immediate attention by the maintenance staff and for developing a check list for frequent use in determining areas of buildings and grounds, as well as furniture and equipment, which may require some degree of maintenance immediately or in the near future.

4. Establishing priorities and scheduling work.

   Frequent inspections with the proposed check list as a guide will serve to locate areas and items requiring maintenance. Urgency of need and the effect of delay upon the particular element of the plant should be the principal consideration in assigning priorities. Correcting a safety hazard in the building or on the grounds may be an urgent maintenance job. Failure of a pump on the hot water system in cold weather would be an emergency maintenance job.

Certain major items of maintenance work can be scheduled for months and even years ahead. For example, exterior and interior painting of buildings can be scheduled for repetition every four or five years.

5. Records and reporting.

The proper functioning of a maintenance program requires a system of record keeping that provides information for following schedules established and assuring that jobs have been completed. It also provides information on time required for each job, materials used and personnel involved. Such records enables the person responsible for maintenance to make accurate reports to the executive officials or governing board, keep most frequently used materials and supplies in stock, and furnish needed information for developing the maintenance budget.

6. Maintenance budget.

An adequate maintenance program can operate only if sufficient funds are made available. The fact that certain items in the plant maintenance program can be delayed one or more years without serious damage to the school program has on occasions caused school officials to reduce the maintenance budget in order to have funds available for other uses. Delayed maintenance can, however, become major repair which results eventually in increased costs for upkeep of the plant. Reduction in the quality of plant facilities from the effects of delayed and neglected maintenance may also reduce the effectiveness of the physical environment on the learning process.

The individual responsible for maintenance should make budget requests based upon his knowledge of needs for at least a year in advance and upon expenditures made during past years as revealed by the maintenance records kept and reports submitted.

Maintenance and operation costs reported in the January, 1968, issue of School Management Magazine[30] show that an average of 3.2 percent of current school expenditures are presently being spent for maintenance and 9.1 percent for operation.

Operating Program

The school plant operation program includes those activities concerned with keeping the physical plant open, comfortable, safe and healthful for the occupants. To accomplish these things the program will need to:

1. Have an individual delegated the responsibility of seeing that all operation activities are carried out satisfactorily. Some of these major activities include the following:

   a. Keeping buildings clean and specific areas both clean and properly sanitized, which requires an adequate staff of trained custodians with appropriate equipment and a sufficient quantity of supplies to do the jobs.

   b. Servicing operating equipment that provides heating, cooling, ventilation, lighting.

c. Storing and distributing supplies and equipment.

d. Keeping grounds free of rubbish, care of lawns, shrubs and other plantings.

e. Checking and repairing of playground equipment and fences.

2. Selecting, assigning and training custodial staff.

Members of the custodial staff have the responsibility of the operation of the school plant which is usually a very complex facility. Qualifications of personnel will need to be established for use in selection of staff. Assignments should be made to best fit worker and job.

Training of the staff is important and must often be done following employment. This may be done by local, area or state training programs. Local training programs are often in the form of apprentice training with the new inexperienced worker assigned to an experienced one for individual on-the-job instruction. A training school may be operated by one or more districts for a period of several days for instruction to all or a selected number of custodians. Some states operate training programs for a specific number of days in various regions of the state for custodial and maintenance workers.

3. Keep records and report.

Records need to be kept that will provide information concerning:

a. Items of custodial equipment and their assignment to individual plants.

b. Amounts and kinds of supplies assigned to and consumed in individual plants.

c. Personnel records.

4. Operation budget.

The operation budget will need to be adequate for meeting payrolls and obtaining the necessary equipment and supplies needed for the efficient and economical operation of the plant. Budget preparation can be done by the individual responsible for the program on the basis of information obtained from operation records and reports and anticipated requirements for the school year.

VI. CONCLUSIONS

1. Developing a plant program sufficiently comprehensive to provide the physical environment that will adequately and desirably house all of the activities in which the pupils and staff of a modern school system are presently and will in future years be engaged, challenges the imagination and ingenuity of school administrators, educational and architectural planners and all other persons concerned with the planning and construction of schools.

2. Responsibility for the planning, construction, maintenance and operation of the school plant rests primarily with the local school district. Constitutions of the various states makes the establishment and maintaining of free

public schools the responsibility of the state. Legislative bodies at the state level have delegated much of this responsibility to the local districts, especially the area relating to plant facilities. Most states exercise only a limited control over the school plant facilities and provide little or no assistance for their operation and maintenance.

Areas in which the state needs to assume more responsibility in the planning, construction, maintenance and operation of the school plant are as follows:

a. Make available in the State Educational Agency sufficient personnel with competence in the field of school planning to assist local districts in the development and implementation of immediate and long-range plant programs. The area of planning and construction in which the personnel would be engaged range from providing assistance in, or making, a school plant survey to participating in the final inspection of construction work on a new or improved plant.

   Personnel should also be available from the State Educational Agency to provide assistance to local school districts in their plant maintenance and operation programs. This assistance to be in the form of:

   (1) Making or assist in making surveys to determine the type and scope of the maintenance and operation programs needed and the personnel requirements for their implementation.

   (2) Organizing and operating schools of instruction in custodial and maintenance work for upgrading employed personnel and training new ones.

   (3) Consult and advise with the local individuals responsible for the care and operation of the plant after a visit is made to the school system for the purpose of observing the results obtained from the functioning of maintenance and operation program, and offer suggestion for improvements if found desirable and necessary.

   (4) Keep local plant officials advised on availability of new materials and equipment and new innovations in the care and operation of plant facilities.

b. Assisting the local district in financing the planning and construction of new plants, rehabilitating and modernizing existing ones and maintaining and operating all the school's plant facilities.

   Since education is a constitutionally directed and generally accepted function of the state and the plant facilities contributes significantly to the effectiveness of the educational program it houses, and the learning process of the individual pupil is definitely influenced by the physical environment which the plant provides, it logically follows that the state should also participate in financing this part of the total educational program.

   The extent to which the state should participate in financing the planning, construction, operating and maintaining of school plants differ widely among the several states at the present time. For the purpose of this paper, it is suggested that state funds be made available to school districts for plant purposes in the same ratio as all state funds are to total expenditure for school purposes. A district, for example, that now re-

ceives fifty percent of its funds from state sources should also receive this same percentage for use in providing and maintaining plant facilities. It is also suggested that these state funds be available only to the local districts which are structured in accordance with standards established by the state's master plan for school district organization. The purpose of such a provision is to assist in eliminating the small inefficient districts which are unable to provide an educational program that meets the needs of all its pupils.

Since the Federal government has begun in recent years a program of partnership with the local and state governments in the financial support of certain special types of education, and the use of designated amounts of these funds for providing and maintaining plant facilities, it is suggested that federal funds for plant purposes be extended to include all areas of the state's master plan of education and they be distributed to the local districts in conformity with the plan used by the state in distributing its funds.

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